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The effects of different biocides against selected drinking water-isolated bacteria in planktonic and sessile states

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The chemical disinfectant chlorine, as chlorine gas (Cl_2) and sodium hypochlorite (NaOCl), has been commonly used for drinking water treatment.[1,2] Although the recommended residual concentration of free chlorine allows to some extent the control of microbial growth in the bulk water, the occurrence of biofilms in chlorinated drinking water distribution systems (DWDS) has been frequently reported.[3,4] Therefore, the main goal of this study was the study of alternative biocides to control biofilm development in DWDS. The effects of sodium dichloroisocyanurate (NaDCC), trichloroisocyanuric acid (TCCA), and pentapotassium bis(peroxymonosulphate) bis(sulphate) (OXONE®) were analysed against two emerging pathogens isolated from drinking water, *Acinetobacter calcoaceticus* and *Stenotrophomonas maltophilia*. The determination of the minimum bactericidal concentrations (MBC) of the selected biocides were based on the European Standard EN 1276, with MBC between 1.56 to 6.25 mg/L for NaDCC, 2.5 to 3.75 mg/L for TCCA, and 172 to 688 mg/L for OXONE®. Inactivation curves were developed and fitted to microbial survival models. The effects of biocides on cytoplasmic membrane integrity were assessed by propidium iodide uptake. The action on biofilm control was analysed against 48 h old biofilms developed on polyvinyl chloride (PVC) and stainless steel (SS) coupons using a 24-wells microtiter plate assay. The bacteria culturability and removal assessment were determined by colony forming units (CFU) enumeration on R2A agar, and by 4',6-diamidino-2-phenylindole (DAPI) staining, respectively. This study reinforces biofilms as chronic contaminants of DWDS and highlights that the understanding of antimicrobial susceptibility of microorganisms to biocides is an important step in the design of effective biofilm control strategies in order to provide to consumers drinking water of adequate microbiological quality.

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